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LAWN ESTABLISHMENT AND CARE

COVER: Garden knolls looking south and east. Showing the effects of high mowing, up to five inches, with regular feeding and weed control. Photo by ELE

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LAWN ESTABLISHMENT AND CARE

ROBERT W. SCHERY

NEARLY a decade ago an article on "Lawn Establishment and Care" for this midcontinental area appeared in the BULLETIN for the first time. How striking the new developments since then. No, the difficult climate has not changed—it is still neither wholly northern nor southern when it comes to lawn selection; the old favorites of lawn seed mixtures, Kentucky bluegrass and varieties of red fescue are still the same, and are still among the best grasses for lawns managed to favor these species; the sophistication of homeowners and availability of information has improved, leading to wider recognition of lawn possibilities; but especially has the introduction of new equipment and products made obsolete many cumbersome procedures of only a decade ago.

Modern merchandising has placed at the disposal of almost every homeowner convenience items, a rarity a few years back. Rotary mowers with easy height adjustment now make it feasible to mow bluegrass and fescue high during the summer, as they should be. This in itself goes far to assure that such a coveted lawn can be held in spite of hot summers. Effective crabgrass controls have appeared, plus mechanical devices for their quick, uniform application. A revolution has occurred in lawn fertilizers, or at least a revolution in our thinking of how they should be used.

All of this does not mean that lawn making and care is easy in a climate having muggy summers, so difficult for northern grasses, and relatively protracted winters, which spell the doom of attractive and glamorous southern lawn grasses.

CHOICE OF LAWN

There are several options for midlatitude lawns. In addition to the favorite bluegrass-fescue turf, hardy varieties of southern lawn species are now available. The newer flare for outdoor living and intensive use makes even limited annual replanting worthwhile, which today is less of a burden because of labor-saving equipment. So, first of all, must come a preference decision between three alternatives. First, is a southern-style lawn of bermuda or zoysia wanted? This is luxurious in summer, but bleak and straw-colored from October until the next April. Secondly, do you want the familiar northern type? This is

Lawn Establishment and Care by Robert W. Schery, Ph.D., Director of the Lawn Institute and nationally known turf authority. He received his Ph.D. from Henry Shaw School of Botany in 1942.

attractive in autumn, most of the winter, and through spring, but going off color or needing special attention half of the summers. Or lastly, will it be a lawn of convenience, abandoned in summer to crabgrass and weeds and seeded with bermuda grass, which is not expected to survive winter, then reseeded with rye grass each autumn for winter greenness. This latter option imitates the "winter grass–summer grass" cycle of the South, which alternates bermuda in summer with expendable ryegrass or bluegrass–fescue for cooler months. The change-over period in autumn and spring is unattractive and bothersome.

Not only is there this choice in the basic type of lawn, but habitual care and usage should also be considered. We will presume that lawns discussed here are "out front," not hidden play areas or athletic fields (which may merit use of some of the coarse hay-grasses, such as Kentucky 31 and tall fescue). Lawn success with the better grasses is less a question of expense than it is of recognizing that different species show differing responses to such matters as preferred cutting height, appropriate season for fertilization, thinning of matting types, diseases peculiar to the species, and the like.

Southern-style lawns are appealing for areas concerned only with summer use; yet the long dormant season, winter weed control needs, and the intensive care required in summer, limit the practicability of such lawns. In general I favor seedings of bluegrass–red fescue mixtures for the mid-continent, even if more exacting care may be needed than farther north. This BULLETIN will therefore emphasize the northern-type lawn, based upon Kentucky bluegrass and red fescue varieties (Chewings, Illahee, Pennlawn, Rainier, etc.). If bentgrass is to be used, it should be treated as a specialty grass and accorded the especial attention of professional care.

BASIC REQUIREMENTS

Lawn Keeping, Southern Style. Southern grasses, that is, bermuda and zoysia grow only during warmer periods. Assuming that soil fertility and moisture are adequate, they are quite active even in the heat of summer, when bluegrass wisely goes semi-dormant.

Bermuda is such a fast and prolific grower, mowing may be necessary twice a week all through the summer. This heavy feeder needs ample fertilization to maintain good color, a monthly application, ordinarily. Clippings should be collected to lessen build-up of a smothering layer, but even then the tangled mat of stems may need thinning from time to time.

Bermuda straw is not stable when the plant is dormant. The dead stems crumble so that the lawn in winter is not good footing. Usually winter weeds such as chickweed, henbit and cresses spring up, making the natural unattractiveness of off-season color even worse. Yet the hardy bermudas are so thick in autumn that it becomes difficult to seed a temporary winter grass into them as is customary under the two-grass system in the South. Autumn overseeding is more for loose, seeded bermuda than for the improved vegetative varieties. U-3 is the most frequently used, although Sunturf,

Tifgreen, Tiffine and others have proven hardy most winters.

Zoysias are not quite so troublesome since they are slow growers. They make a resistant turf underfoot, even in winter, the straw not crumbling as does bermuda. The hardy varieties, Meyer zoysia especially, are the usual planting. They make a tight sod such that winter-grass inter-seeding is not practicable. The zoysia can be thinned, if necessary, by burning in late winter to reduce mat accumulating, but this presents a period of unsightliness.

The biggest drawback to zoysia in mid-latitude climates is its very slow establishment. Even under the best of care a tight sod is seldom obtainable in less than three summers. Regular fertilization and weed control during the interim are necessary. Do not be misled by "miracle" claims for zoysia; it is not that good, even in the deep south. Furthermore, as with the named varieties of bermuda, Meyer zoysia must be hand planted from sprigs or plugs. varieties do not come true from seed.

Lawn Keeping, Northern Style. Kentucky bluegrass–red fescue mixed turf consists of grasses which thrive best in the cooler seasons. A northern lawn seed blend of quality will contain at least 80% of these proven perennials, and little or no so-called temporary nursegrass. Unlike bermuda and zoysia varieties, bluegrasses and fescues are everywhere available as seed. Natural Kentucky bluegrass is harvested from "wild" stands in Kentucky, Missouri and northward, and has much to recommend it as the basic bluegrass component for this area. Quality red fescues mostly come from Oregon.

Autumn, preferably September, seeding is to be preferred. Spring seeding may get by in light shade, or when

Zoysia matrella

summer heat and weeds are not too severe. Fertilization should receive emphasis in the autumn and be minimized as spring progresses. Many lawns in the area fail because bluegrass and fescue are forced to "soft" growth with too much nitrogen during the heat of summer.

Summer is the season of lawn travail. Weeds are always a threat, crabgrass especially. High mowing helps to keep sod thick enough to shade out much crabgrass. The remainder, at least in the drier years, can be controlled rather effectively with chemicals. The pros and cons of watering will be discussed later, but, in general, watering causes as many problems as it cures.

By observing a few summer precautions a bluegrass lawn in this area can be kept sparkling from early autumn until nearly Christmas, and from early spring until the hot weather of summer begins. During late July and August it will seldom remain attractively green and actively growing. Temporary browning of unwatered bluegrass during drought does not kill well-established turf, which revives immediately after rain. As a matter of fact, the weeds are generally hurt more by drought than is the grass, with ultimate benefits to the lawn as autumn approaches.

Annual Seedings. I will not argue whether annual, expendable seedings reflect defeatism, or a common sense approach to tough climatic conditions. Many middle latitude lawns are allowed to turn to crabgrass and weeds in summer, either by choice or unskillful handling. Mowed regularly, they are not necessarily unattractive. The repressed northern grasses might volunteer here and there in autumn, but if the lawn is to look well through winter, a uniform seeding must be made in autumn. Quality seed mixtures of bluegrass and fescue will sprout readily in a scuffed up "mulch" of old crabgrass. More frequently ryegrass is sown. This cover deteriorates in spring, until crabgrass once again takes over. When one hesitates to rely upon crabgrass, sowing the non-hardy bermuda grass seed is possible. It grows rampantly through the summer, only to die in early autumn as the cycle is renewed. This is an unending and often exhausting cycle. It will not provide a really top lawn, even though at certain seasons it is not unattractive. The program, if it can be called that, merits no further discussion, since seasonal summer-winter care parallels practices for southern and northern lawns.

The Grasses

The Bluegrass group (Poa). Lawn bluegrasses have boat-shaped or spoon-like tips to the leaves, easily felt by running the leaf between thumb and forefinger. Several species may volunteer, but only Kentucky bluegrass *(Poa pratensis)* is ordinarily needed for lawn purposes. Canada bluegrass *(Poa compressa)* sometimes shows up on poor soil, but makes a thin, scrawny turf. It can be recognized by its flattened stems.

Annual bluegrass *(Poa annua)* is frequent in spring, having volunteered from seed to produce a fine, bright green turf. Unfortunately it soon sets seed heads below cutting height of the

Poa pratensis—Bluegrass

mower. The plant, an annual, dies in late spring, leaving summer voids and weed problems. Annual bluegrass is usually considered a winter weed, although it would make an acceptable "winter grass" for lawns with summer bermuda or crabgrass. Rough bluegrass *(Poa trivialis)* is a frequent component of seed mixtures. It resembles bentgrass more than bluegrass, spreading by stolons, and forming dense colonies. It is adapted only to moist shady situations. While not harmful, it is of relatively little use in this climate.

The traditional source of Kentucky bluegrass seed has been that harvested from "wild" or volunteer stands, in the pastures and meadows of Kentucky and Missouri northward into Canada. Some sods have doubtless been there since colonial times. In any event this grass (termed natural Kentucky bluegrass by the trade) has endured the climatic, soil and disease tribulations for decades, without pampering. One would suppose that a certain amount of natural selection has taken place, such that in the myriad of strains adapted to specific local conditions, ecotypes, one would find in natural Kentucky bluegrass a suitable candidate for almost any lawn condition. Indeed, tests have shown that natural Kentucky bluegrass is quite flexible. Seed harvested in any portion of the range has proven adaptable to other sections.

Plants selected for unusual appearance, resistance to disease, or suchlike, have been isolated and increased for seed in western regions where "contaminating" volunteer bluegrass is not a problem. Although such varieties may be excellent for the quality for which they are chosen, they can exhibit reduced endurance in lawns not just to their liking. *Merion,* the first widely-acclaimed variety, has an attractive low growth but it has not done too well in the southern portions of the bluegrass zone. Moreover, it is

a heavy feeder, the seeds are slow to germinate and it is afflicted by rust in addition to some other diseases which cropped up after its original selection for resistance to leaf spot.

Newport is a tight growing selection with good autumn color, picked up on the Oregon coast. Final evaluation for this climate remains to be completed. *Park* is a selection from Minnesota, gained from intermixing a number of the more vigorous selections from that area. In appearance and performance it seems little different from natural Kentucky bluegrass, although the husky seeds provide quick sprouting, on a par with the best of natural Kentucky bluegrass. *Delta* is a selection from Canada, a good seeder, which appears little different than natural Kentucky bluegrass. *Arboretum*, a mass selection from the Missouri Botanical Garden Arboretum, is likewise similar to natural bluegrass. *Troy* is an imported selection from the Near East, which seems to have no especial advantages.

A great many other selections are under test, and will reach marketing in the years ahead. The experimentally-minded might want to try one or another named variety, but for average lawns a hard core of natural Kentucky bluegrass should serve well, perhaps embellished with one or more named varieties mechanically blended in. This gives a wide spread of candidates for the difficult summer conditions.

Red fescues (Festuca rubra in variety*)*. The red fescue group, the better varieties of which come from Oregon, make admirable companions for bluegrass. They are tolerant of poor soils and shade. The seed is larger than that of bluegrass and provides seedling cover a bit more quickly, helping to lessen the need for so-called nursegrasses. The red fescues' requirements are quite similar to those of bluegrass, and the two grasses blend well.

Red fescues have a thin, wiry leaf, similar to the sheep's fescue that volunteers in the shade of trees, especially under oaks in the area. They do not become clumpy, as does sheep's fescue. The difference between varieties is minor, although Chewings, Illahee,

Festuca rubra—Red Fescue

Cynodon dactylon—Improved Bermuda

Pennlawn, Rainier and others claim density advantages over the parent Creeping Red.

Bentgrass (Agrostis). Bentgrasses are seldom recommended for lawns in middle latitudes. The fine-textured species, creeping bentgrasses *(A. palustris* and *A. canina)* of golf greens, and more erect colonial types *(A. tenuis,* often included in seed mixtures) prefer humid climates with mild summers. They need constant attention to remain attractive. Redtop *(A. alba)* is a coarser species, frequently recommended as a "nursegrass." The theory is that it will cover quickly, then give way to better grasses. But certain redtop plants may persist for years, becoming coarse clumps that are hard to mow. However, with modern planting techniques such as mulching there is little need in any event for fast sprouting species, which only compete with the more desirable permanent grasses for space, moisture and nutrients, thus setting them back.

Ryegrass (Lolium multiflorum, Italian or annual ryegrass; *L. perenne,* perennial ryegrass*).* Annual ryegrass is the chief component of cheap seed mixtures. Perennial ryegrass is not much longer lasting than is annual in mid-latitudes. Neither can be recommended except for temporary winter overseeding. They are coarse bunchgrasses without rhizomes or stolons. They should not be used as a nursegrass in seed mixtures, at least in any sizable percentage, for they are even more competitive in new seedings than is redtop. I would not recommend them even for temporary summer seedings, since some seed may persist in the soil to become troublesome when the permanent lawn is planted in autumn.

Summer Grasses

Bermuda (Cynodon dactylon). Common bermuda grass from seed yields a mixture of types which provide attractive turf, if well maintained. It is open enough to be interseeded with "winter grass" as it browns in early autumn. Bermuda grows only during hot weather. It is seldom possible to achieve good cover before late May.

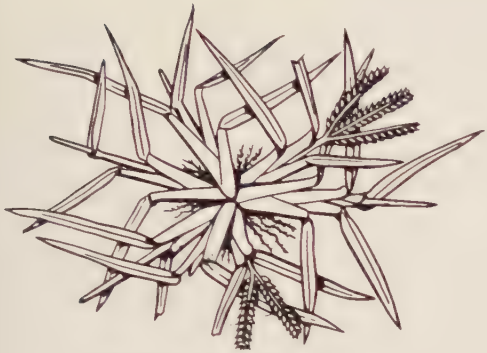
Several selections have been chosen, perpetuated by vegetative (hand) planting. U-3 has survived most mid-continent winters. *Sunturf (C. magenesii)* is a presumed natural hybrid from Africa, probably hardy. Varietal selections made at Tifton, Georgia, *(Tiffine, Tifgreen)* seem to survive most winters in this area, too. The difficulty and expense of planting lessens their appeal. Local nurseries can supply plugs of sod which are planted the same as potted plants, or sprigs which may be scattered over cultivated soil, topdressed a bit, and kept continuously watered until rooted.

Crabgrass (Digitaria). Two intergrading species are common, *D. sanguinalis,* hairy crabcrass, and *D. ischaemum,* smooth crabgrass. Crabgrass is perhaps the most insidious summer weed of the area, spreading by trailing stems and gradually smothering out all competing vegetation. On the other hand, it does make a summer cover not too unattractive, where no better turf is maintained. In general, we would consider crabgrass a weed and call for its elimination according to instructions in a later section.

Nimblewill (Muhlenbergia schreberi). Nimblewill has become quite a pest over the entire Midwest, and in many areas surpasses crabgrass as a source for complaint. It is a dark bluish-green, and often seems to prefer partial shade where crabgrass never grows. It has knob-like joints on the trailing stems, Like bermuda or crabgrass, it is slow to gain color in spring, and quick to

Digitaria spp.—Crabgrass

Mulenbergia schreberi—Nimblewill



Eleusine indica—Goosegrass

Seteria viridis—Green Foxtail

go off color in autumn. During late summer it enlarges into heavy patches that crowd desirable grasses. There is no selective way to eliminate nimblewill. Hand pulling where infestation is light is suggested, or spot-treatment with a herbicide and reseeding. Planted grasses, well-tended, may in time overwhelm nimblewill.

Goosegrass (Eleusine indica). Goosegrass is often confused with crabgrass, to the dismay of homeowners who try to kill it with crabgrass remedies in the usual manner. It has a flattened stem and does not spread and root at the joints as does crabgrass. An annual, moved northward from the tropics, it flourishes primarily on hot compact soils unfit for its betters. In good turf it seldom is a problem, but often it can be eliminated by repeated treatments with crabgrass chemicals such as DSMA.

Foxtail (Setaria sp.). The foxtails occur primarily in new lawns and give way in time to the established turf. They can be recognized in the late autumn by the burr-like seedheads. DSMA speeds their disappearance.

Broad-Leaf Weeds

Broad-leaf or dicotyledonous weed possibilities for local lawns are too numerous to list completely. Some of the greatest pests of former years, such as dandelions and plantains, are so easily controlled with the 2,4-D group of chemicals as to be but a minor inconvenience. Even chickweed is becoming readily controllable with several weed killing chemicals applied in autumn or early spring.

The chief lawn weeds appearing from autumn through early spring, are henbit *(Lamium amplexicaule)*, chickweed *(Stellaria media)*, and various cresses (members of the *Cruciferae)*.

Weeds prominent in hot weather are the dandelions *(Taraxacum officinale)*, the plantains or buckhorns *(Plantago major, P. lanceolata)*, clover *(Trifolium repens)*, knotweed *(Polygonum aviculare)*, spurge *(Euphorbia maculata)*, carpetweed *(Mollugo verticillata)*, milfoil *(Achillea millefolium)*, and black medic *(Medicago lupulina)*.

Stellaria media—Common Chickweed

Euphorbia maculata—Nodding Spurge

Medicago lupulina—Black Medic

Mollugo verticillata—Carpetweed

Preparing the Seedbed

A number of good lawn books deal extensively with seedbed preparation. Proper grading and drainage should be attended to at the time of house construction. Topsoil importation is a declining procedure, since topsoil is generally expensive and may be of poor quality and full of weeds. Satisfactory results are usually possible by mixing plenty of fertilizer into the residual soil and letting the grass build up the organic content. Compacted soil, a familiar condition after home construction, should be loosened to a depth of three or four inches. This is best done with power equipment, a tractor-pulled disc or rotary tiller.

A phosphatic fertilizer might be mixed in profitably at last cultivation, since phosphorus moves only slowly through the soil and may not reach the root zone for some years when applied at the surface after the lawn is up. There is no need to pulverize the seedbed, as this only contributes to crusting upon watering. Soil clods about the size of pebbles resist slaking longer than does a dust-fine surface.

Nor is there ordinarily any need for rolling a new seedbed, other than perhaps to point up low spots during leveling. It is especially unwise to use a heavy roller or any heavy equipment on a wet clay soil, which would recompact the soil, undoing the benefits of cultivation.

Most soils of the area are not very deficient in lime. The only sure way to know, however, is to have a soil test for pH. If the test shows acidity at 6 or lower, apply crushed agricultural limestone at the rate of 50 to 100 pounds per 1000 square feet. Organic residues or soil conditioners such as peat, compost, sawdust, vermiculite, may help loosen heavy soils, and make watering and initial attention a bit less difficult but they contribute little fertility and are laborious to mix into the soil.

Seeding and Mulching

After the seedbed has been leveled, the next step is to sift a good seed

A spreader is convenient for even regulated distribution of seed, fertilizer and other lawn materials.

mixture uniformly over the surface. Upon watering, seed will settle among the soil clods if the surface has been left pebbled. Raking or rolling are seldom needed.

A number of helpful mechanical devices are sold for spreading seed, fertilizer and other lawn materials quickly and uniformly. The cyclone, whirlwind-type is the quickest and easiest, although the drop-from-hopper spreader carts are usually a bit more accurate. Quality seed mixtures, mostly bluegrass and red fescue, should be sown at rates of about 3 or 4 pounds per 1000 square feet. If previous application of fertilizer was neglected, it can be applied along with the seed, without harm, for initial watering will wash the seed free from sprout-inhibiting salts. Ten to twenty pounds per 1000 square feet of such lawn fertilizers as 20–10–5, 15–5–5, or 10–6–4 are appropriate.

The better grasses are not so quick to sprout as are coarse haygrasses. Where humidity is constantly maintained and temperatures are mild, good seed should be showing green in about a week. With bermuda grass, seed with the hulls removed is faster to sprout than that not hulled.

A mulch after seeding is certainly worth applying. The usual mulch is straw, scattered evenly to a depth of 3 or 4 straws. Other inexpensive, loose materials may be used, and there are even prepared nettings (Erosionet) sold for the purpose. A very quick way to get seedlings started, especially in the cooler, dry weather of autumn, is to cover the planted and once-watered seedbed with clear polyethylene plastic, tacked down around the edges with large-headed nails or wire wickets. The system is self-irrigating, in that water evaporated from the soil condenses on the plastic and drips back again. Also, this "plastic greenhouse" traps heat during the day, causing faster sprouting if weather is cool. Be careful not to let too much heat accumulate under the plastic on warm sunny days, for temperatures much above 100° F. can kill moistened seed within a few hours.

When to Plant

The most effective season to plant a northern grass blend is in early autumn, just as soon as soil moisture has been replenished. The seedbed might be prepared in August, when dry soils and tillage combine to kill the weeds. In mid-latitudes watering sufficiently to soak a seedbed, and keeping the surface moist, is certainly expensive, if not impossible. Therefore, seeding might best await the first soaking rain of September. Once soaked, frequent light syringings can keep the seedbed moist, to bring the grass up quickly. Adding a mulch would help retain moisture and make the job easier.

Other advantages of autumn seeding are: the shortening days, which lessen moisture evaporation; a season when most weeds are declining although a few winter weeds such as cresses are just beginning; warmer, drier cultivatable soils; and more time for lawn making, free from the press of spring chores.

If, for any reason, seeding is missed in early autumn, it is still better to sow seed late rather than the follow-

ing spring. Even if the seed does not sprout, it will remain unharmed in the soil for an early start in spring.

If autumn seeding is impossible, it may be worth taking a chance in spring rather than to wait a whole year. In such instances perhaps soil tillage can be skipped, if the seedbed had been sufficiently leveled and settled beforehand. The seed may be spread in late winter or very early spring on a frost-pocked soil surface. Nature cultivates the soil by freezing-thawing through the winter, and seeds will sink into the alternatingly pitted and thawed surface. It will be slow to sprout in the cold soil of spring, but still ahead of sowings that await the drier weather of late April or May for soil preparation.

Late spring and early summer seedings are seldom to be recommended here, although in some years when summers remain luckily cool, or where special conditions, such as slope or shade, favor the cool-weather grasses, success may be possible. But summer seeding is a risk and entails a lot of work keeping new seedings watered. Ordinarily we would suggest sowing a temporary cover to get through the summer, then seeding permanently in early autumn. A useful temporary cover for middle latitudes is Korean lespedeza. This legume is reasonably attractive, yet will not persist and be competitive with later grass, as would ryegrass, redtop or clover.

Bermuda grass seedings, or bermuda and zoysia vegetative plantings, should be made only after the weather has warmed in spring. There is little point in starting either one later than mid-summer, since at least six weeks are needed for establishment and spread. Sprigs or plugs started late may not withstand winter.

Maintaining the Established Lawn

In the following paragraphs, under appropriate headings, the major lawn care procedures are reviewed. In each instance discussion centers primarily upon the bluegrass–fescue lawn. Qualifications for southern grasses are pointed out where this is necessary.

Mowing. The opening pages emphasized the importance of mowing-to-fit-the-species in troublesome mid-continent climates. Of all mismanagement possibilities, close clipping, called scalping, is probably the most disastrous for the bluegrass–fine fescue lawn in this area. The mower should be set at least two inches high through the growing season; after the grass leaves are browned by bitter winter weather, a single close cut in early March can reveal more quickly the bright new leaf tips of spring. Three-inch mowing through summer would be even better, and is in itself an excellent crabgrass control.

Obviously mowing height has implications for choice of mower. Reel mowers cut rather poorly when set high, because the grass is "blown down" ahead of the blades, rather than being sucked up as with a rotary. Thus for the bluegrass–fescue turf, favored by high mowing, rotary mowers are suggested, and those with simple height adjustment to 2 or 3 inches.

For bermuda grass and those infrequent bentgrass lawns, a closer mow-

ing is necessary. A one-inch cutting height keeps these trailing species presentable. Zoysias are usually mowed at an intermediate height, say about 1½ inches. Zoysia is an unusually tough grass; poorly constructed mowers may have a struggle keeping it mowed. For bents, bermudas and zoysias, reel mowers are satisfactory. Older reel mowers have only five blades, an economy feature, and do not mow as attractively as six-bladed machines.

With bluegrass–fescue lawns, clippings can usually be left without harm or unsightliness. These species grow upright, and the clippings, unless long from too infrequent mowing, settle near the soil, generally decaying in the warm humid weather without making a mat. Since clippings during the year contain nutrients equivalent to a fertilizer application, leaving them on the lawn makes sense if they do not detract from the appearance. It has been demonstrated that soil aggregation and water penetration are improved under grass clippings, although on a flourishing lawn such a ubiquity of fine rootlets occurs that soil offers few structural problems.

Bentgrass and bermuda are vigorous growers. They must be mowed frequently and be "pushed" for new leafage by fertilizing and watering if they are to look well. The mat formed by layers of undecomposed vegetation may build up under this intense management. This mat insulates the soil from air and moisture, and eventually smothers out the grass. Collecting clippings helps forestall a mat. Where a mat has accumulated, thinning should be undertaken, by vigorous raking before mowing, or in extreme cases, with special spiking or vertical-cutting machines.

A mowing schedule is hard to suggest. The best general recommendation is to cut at any time the grass has added 50% to its desired height, usually one inch for bermuda grass and two to three inches for bluegrass–fescue. Removing more than one-third the green leafage stalls root growth. Bluegrass lawns grow most in spring and may need little mowing in summer. Bermudas need frequent cutting all summer. Zoysia is a slow grower, although to look spruced up, it should be clipped weekly.

More time is spent on lawn mowing than on anything else. It behooves the lawnsman to pass the time as pleasantly as possible. Mowing can be relaxing and pleasurable if good equipment of sufficient size is secured. Do not cut corners in purchasing a lawn mower. Chose a durable make, designed for convenient operation and manipulation, and one that starts readily, that is large enough to mow the whole lawn in a reasonably short time. There are several semi-automatic starting devices. Practically everyone uses a power mower nowadays, and the riding types give many oldsters an excuse for youthful excitement without seeming silly.

Fertilization. The source of a nutrient matters little to the grass, just so it is available when needed. However, for lawn tending convenience, differences in fertilizers can be important. Many fertilizers are custom-tailored especially for lawns, and lawn spreader

application. The most economical fertilizer consists of simple chemical salts that release ammonium, nitrate, phosphatic compounds, and potassium. The nutrient elements are largely soluble and become available to the grass immediately upon application and watering. Pelleted or granular forms are safer than dusty formulations, since the pellets roll from grass foliage to the soil and cause no burn. Soluble fertilizers for application in water, as with siphon attachments to the hose, are concentrated materials of this type. Per unit of nutrient they are usually considerably more expensive than are dry chemical fertilizers.

Practically everyone uses a power mower nowadays.

Organic fertilizers pack less power, and are somewhat more expensive per unit of nutrient. Manures fall in this category, and packaged products from tankage, vegetable wastes, dried blood, treated sewage, etc. The nutrients are released only as decomposition proceeds on the lawn. Hence, organic fertilizers release the nutrients more slowly over a longer span of time, and will not "burn" grasses as readily as do chemical types.

In recent years man has imitated the organic fertilizers by tailor-making complex molecules, the urea-forms, from urea and formaldehyde, which break down slowly at a determinable rate. Similar results are obtainable by coating the pellets of chemical fertilizers with resin which breaks down slowly. In either instance the objective is gradual release of nutrients.

Most lawn fertilizers are composed of two or more of these types, and contain some quickly soluble nutrients for immediate effect as well as slower-release components. The slow-release of nitrogen is especially useful for the southern grasses which continue growing all through the warm season and should have even stimulation for uniform growth. With a northern lawn, which in this climate goes partially dormant in summer due to hot weather, the less expensive chemical fertilizers might serve well. Bluegrass' main need for feeding is in the autumn, the season when it builds up its reserves. Nitrogen supplied then is trapped by the grass and soil, and is carried without much loss until used by the grass.

Except for the bermudas and zoysias, summer feeding might well be minimized. Nitrogen in hot weather benefits the weeds more than the grass, and indeed may encourage such lush leafage that this falls prey to disease. For the mid-continent bluegrass lawn one or two generous feedings in autumn, with perhaps a lighter spring feeding, should suffice. Of course, variety of grass, local soil fertility, and general maintenance practices will dictate fertilization needs. But do be cautious about stimulation in late spring and summer. Even in early spring excess fertilizer can intensify leaf spot.

In fertilizing the lawn, follow the rates recommended by the manufacturer. Usually one to two pounds of available nitrogen is supplied per 1000 square feet, that is, ten to twenty pounds of a 10–6–4 mixture, which is 10% nitrogen. In a fertilizer analysis nutrients are always listed in nitrogen–phosphorus–potassium order, as the percentage contained.

If misapplied, any fertilizer, even limestone, can burn the grass. Spreaders should be filled off the turf, checked for complete shut-off when stopped or turned on the lawn. Even moderately excessive rates of chemical fertilizers may discolor turf during hot weather. The organics and synthetic organics are less apt to cause this trouble.

Bolster Seeding. An occasional overseeding has merit, for even with the best of attention there is apt to be some turf loss or thinning. Having proper candidate grass plants ready for voids makes correction easier. A half-rate bolster seeding in autumn or early spring can provide insurance at little cost. As with seeding a new lawn, overseeding is most conveniently and accurately carried out with a spreader, the same machine used for fertilizer and other dry materials.

Weed Control. Earlier pages list some weeds that are prominent members of the lawn community. Their elimination by mechanical or chemical means will be only temporary, unless weeds are replaced by grass. Thus, the first step in weed control is good general lawn maintenance.

Fortunately, the day of having to handpluck weeds has largely disappeared. There are now available chemicals which will selectively eliminate most weeds with little or no injury to the grass. The major breakthrough on this front was 2,4-D (2,4-dichlorophenoxyacetic acid), which, at rates used, affects most dicotyledonous plants while not injuring grasses. Numerous 2,4-D sprays and granular concoctions today easily rid the lawn of dandelions, plantains, young knotweed or spurge, ground ivy *(Glechoma hederacea)*, and several winter weeds. Use this spray only on warm, windless days. Minor alterations of the 2,4-D molecule have yielded such compounds as 2,4,5-T and 2,4,5-TP (silvex), which kill certain weeds resistant to 2,4-D, such as clover, oxalis, mouse-ear chickweed and other tough customers.

The 2,4-D family of chemicals is effective at exceedingly light rates, usually not much over one pound of acid per acre. Marketed formulations are seldom hazardous if directions are

followed carefully. Nevertheless, weed killers, mishandled, can be dangerous. Not only may they injure the grass if over-applied, but drift or volatilization may bring injury to shrubbery and ornamentals. Tomatoes are especially susceptible to slight traces, and redbud suffers from silvex applied yards away.

Selective control has not been quite so easy with grass weeds in grass. The search has centered mainly on crabgrass herbicides which will not injure lawngrass. Fortunately bluegrass and fescues are among the more resistant species, so that a number of products have been found which will eliminate the annual grasses without serious discoloration of these perennials.

There are two approaches to the elimination of crabgrass and other annuals, such as goosegrass, foxtail and even chickweed. A "chemical blanket" may be spread on an established lawn before crabgrass sprouts; the pre-emergence way. Treatment may be made in autumn, although spring application before soils warm to the crabgrass sprouting temperature of about 60° F. lessens chance of dissipation of the chemical.

Various arsenic materials at relatively high rates, 15 to 25 pounds per 1000 square feet, control crabgrass and other sprouting seeds. Arsenic is a dangerous poison and can build up soil toxicity if over-applied. Be careful when using or handling calcium arsenate, lead arsenate or arsenical mixtures such as PAX. Chlordane, an insecticide, is reasonably effective as a pre-emergence herbicide at 1½ to 2 pounds per 1000 square feet. There seems to be little danger from over application of this chemical. Zytron and Dacthal are newer developments, quite effective at rates even lighter than chlordane.

Post-emergence control involves treatment of the crabgrass plant after it has sprouted. Potassium cyanate and mercury compounds (PMAS) have served more or less effectively through the years, but the arsonates (DSMA, AMA) have superseded them. Two applications of arsonate about a week apart kill crabgrass, goosegrass, dallisgrass *(Paspalum dilatum)* and even mouse-ear chickweed *(Cerastium vulgatum)* which is rather resistant to 2,4-D. For common chickweed, a familiar spring problem in the area, 2,4-D applied in warm weather, or combined with arsonate, and silvex, and neburon have proven effective.

Weeds are more susceptible to chemical control when growing vigorously. Treatment thus works best on mild days after rain. Also, weeds succumb more readily to herbicides in their younger stages. Knotweed and spurge become notoriously resistant late in the summer. Wild onion *(Allium sp.)* needs repeat treatments with 2,4-D, perhaps over a series of years, in midspring and autumn.

For some weeds there are still no selective controls, for perennial grasses especially, such as quackgrass *(Agropyron repens)* and nimblewill. The best that can be recommended is hand pulling, or spot treatment with nonselective herbicides such as dalapon, TCA, amino triazole, simazin, even gasoline or kerosene. Replanting must follow, of course.

Watering. The summers are few in which lawns will continue green and growing all season without supplemental watering. For constantly green turf, there is not much choice, even though in climates such as this, adequate irrigation can be difficult and expensive. In July and August at least one inch of water per week, evenly spread over the lawn, would be required, in default of rain. It must be applied slowly enough to soak in. A sprinkler system of sufficient capacity, adequate water pressure in the mains, and no restrictions on watering are all necessary. In hot weather midday watering can sacrifice as much moisture to evaporation as sinks into the soil, at least with small droplet sprays, the kind recommended for new seedings. Seldom is the investment for really adequate equipment merited, as might be the case in arid climates, viz., underground piping systems and high capacity outlets, such as used in Los Angeles and Denver, since watering in the mid-continent is for only a short season.

As suggested earlier, lawn watering is not an unmixed blessing. Southern grasses benefit from watering more than the northern ones, because summer is their most active season. Sprinkling very frequently helps the weeds more than the northern grasses. Bluegrasses and red fescues are partially dormant because of high temperatures. Crabgrass thrives on frequent light wettings. Excessive crabgrass from haphazard watering could cause more lawn damage than drought, at a season when northern grasses are least well equipped to fight back.

Watering should be prolonged enough so that moisture seeps all the way down to damp subsoil. On the heavier silt and clay soils this might require slow sprinkling for several hours. Be certain of deep penetration by cutting out a soil plug, and noting dampness all through the root zone.

Watering can be initiated when grass seems on the verge of wilting, marked by a bluish cast, and a tendency for footprints to persist because the turf lacks its usual resiliency. One soaking per week should suffice to carry grass to the next "verge of wilting." Meanwhile the soil surface may dry, inhibiting newly sprouted weeds stimulated by the watering. Constant watering which keeps the root zone saturated forces shallow rooting of the grass; should watering then cease, demise is likely. Summers in middle latitudes exhibit such a high rate of evaporation and transpiration, however, that waterlogging of the soil is most unlikely.

Most mid-continent soils are heavy, consisting of clay and silt. Their water holding capacity is much greater than with sand but water penetration is slower. Watering should be slow enough so that no run-off from the surface is wasted, and long enough so that an inch or so of water soaks in. Local sandy soils require less prolonged, but more frequent, watering.

Shallow watering with makeshift equipment is not worthwhile. It can stimulate weeds, or break grass dormancy, temporarily exhausting food reserves. Good turfgrass is accustomed to summer drought, and revives unharmed for the experience. In fact grass seems to husband its strength by

turning dormant during heat and drought. The best bluegrass seed years are those with scorching summers followed by ample rain in autumn. So if you can accommodate to temporarily brown turf, this will not endanger your lawn and its attractiveness at other times of the year.

Insects

Lawn insect problems are fortunately few. Ants, chiggers and mosquitoes prove nuisances, but do not injure the grass.

Grubs show up in the soil from time to time, mostly of the June beetle, although sometimes similar Jap beetle larvae occur. The grubs chew off the roots just beneath the surface, causing the grass to dry out and lift like a carpet.

Sod Webworms, the larvae of lawn moths, build silken tubes nestled in the crowns of grass, and consume the tops. They are becoming more troublesome in the Midwest. Occasionally, *Chinchbugs*, small black and white insects which can be seen if shaken onto a white paper, suck juices from the grass, bleaching it into irregular patchy areas.

Fortunately these insects are all controlled by any one of several effective insecticides, chlordane, dieldrin, aldrin, heptachlor, diazinon. For soil insects and those in the crowns, it is preferable to drench the insecticide into the turf. Insecticides are not likely to burn the grass as might herbicides.

Disease. The better grasses have survived through the ages without fungicidal help, and pretty well outgrow disease. Nevertheless, for the finest sparkle, and especially with some of the named varieties subject to epidemic, fungicidal treatment may be justified.

In cool damp weather of spring, *Leafspot* may attack northern grasses. Symptoms are purplish margined splotches on the leaves, and if infection goes far enough there can be rotting at the crown and severe thinning.

Summer diseases are more prevalent on bentgrass than on other species, but some of the southern grasses may be afflicted. Identification is difficult even for the expert, so that blemishes not attributed to drought, insects, dog urination, spilled chemicals or some such cause, usually get labeled with an inconclusive name such as *Brown Patch* or *Melting Out*.

In any event, by the time a disease really shows, it is too late to do much about it. A change to drier weather normally controls the infection. Thus the best defense is preventive treatment, ahead of seasons or weather known to foster disease. The homeowner, unskilled in disease identification, would choose "general purpose" fungicides, more or less effective against a wide array of diseases. The metallic dithiocarbamates, such as Zineb and Maneb, mixtures of metals and organics (Kromad, Formula Z), mercurials (phenyl mercuries, mercuric chloride), antibiotics (Actidione-RZ), or other garden remedies (Thiram, Captan) are useful.

Summary

Lawn keeping in middle latitudes is not quite so simple as it would be either farther north or farther south, nonetheless it *is* a challenge to the gardener. Having a really good lawn reflects appreciable understanding of the turf community and its needs.

Although several years of trial and error may be required to gain experience on how best to manage your particular choice of grass, on your especial soil and location, a few simple procedures, timed well, can do much to assure success. Choose grass wisely, sow northern types in autumn, mow bluegrass–fescue high, emphasize fertilization for northern grass in autumn, treat for weeds and pests as needed. Elaborate procedures are not particularly necessary for this climate. Aerification is of value mainly for heavily trodden golf greens, or matting bermudas. There is only occasional need for rolling, and watering is optional except in time of great drought. Growth regulators, top-dressings, soil amendments, microbe stimulators are all luxuries and are seldom really needed. Concentrate your main efforts upon timely seeding, proper fertilization, and intelligent mowing. A creditable lawn should then be yours, with only moderate expenditure of time and funds.

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